

Wheelchair Control using Android Mobile and Arduino Controller

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Abstract— This project is designed to give advanced and innovative technologies to the people facing various degrees of disability. This disability made us think about an idea to support them, so that they can help themselves in their day to day activities and are not totally dependent on other person. So a wheelchair has been designed to serve the purpose. BY using android mobile phone motion of the wheelchair is controlled, to send the message to the helper and to automate the home appliances. A smart phone advanced with Android Operating System, which is widely used everywhere can be used to run the application for navigation. The mobile phone's Bluetooth is linked to an external Bluetooth which is further connected to the motor drivers via Arduino which control navigation and the home appliances like fan, lights etc. The wheelchair has two DC motors which are powered with separate battery.

Key words: Android, Wheelchair Control, Accelerometer, Home Automation, Appliances, Arduino, DC Motor

I. INTRODUCTION

In this system smart phone with android operating system is used to control the motion and navigation of the wheelchair, to send the message to the helper and to automate the home appliances using same application. A smart phone with Android Operating System, which is widely used everywhere can be used to run the application. The smart phone has inbuilt accelerometer to control the movement of the wheelchair. So there are two ways we can control navigation one with keys and on with accelerometer. The person can send message to the for help regarding washroom, food etc. The mobile phone's inbuilt Bluetooth is linked to an external Bluetooth module which is further connected to the relays via Arduino which control the home appliances like fan, lights etc. The wheelchair also has a GPS module to track the current position of Wheelchair and to automate the path of the wheelchair.

II. LITERATURE SURVEY

Real-time control of wheelchairs with brain waves a new signal processing technology for brain machine interface applications. Recently technological developments in the area of brain machine interface (BMI) have received a great deal of attention. Such systems allow elderly or handicapped people to interact with the world through signals from their brains, without having to give voice commands. BTCC's new system combines RIKEN's blind signal separation and space-time-frequency filtering technology to allow brain-wave analysis in as little as 125 ms, as compared to several seconds required by conventional methods. Brain-wave analysis results are displayed on a panel so quickly that drivers do not sense any delay. The system has the capacity to adjust itself to the

characteristics of each individual driver, and thereby is able to improve the efficiency with which it senses the driver's commands. Thus the driver is able to get the system to learn his/her commands (forward/right/left) quickly and efficiently. The new system has succeeded in having drivers correctly give commands to their wheelchairs. An accuracy rate of 95% was achieved, one of the highest in the world.

Plans are underway to utilize this technology in a wide range of applications centered on medicine and nursing care management. R&D under consideration includes increasing the number of commands given and developing more efficient dry electrodes. So far the research has centered on brain waves related to imaginary hand and foot control. However, through further measurement and analysis it is anticipated that this system may be applied to other types of brain waves generated by various mental states and emotions.

Blind signal separation (BSS) is a technology that separates the noise components and useful signal components from brain signals that can be used to control the wheelchair. It utilizes only on-line- recorded EEG signals.

Space-time-frequency filtering is a technology which extracts space and time patterns and frequency oscillation data from EEG electrodes to discriminate significant features and components which are able to reliably control the wheelchair.

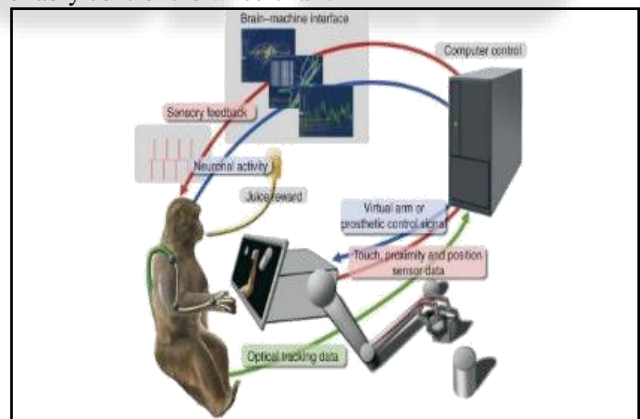


Fig. 1: Brain Mechanism

III. SOLUTION PROPOSED

In this project, the inbuilt accelerometer of the Smartphone has been used in the wheelchair to decrease the difficulty to drive and the price of the system. An android application consisting of controlling wheelchair by the movement of mobile has been made it very simple. Which sends its data via Bluetooth to the required circuitry to move the wheelchair. Also an option to control the lights, fan and other appliances in the room has also been provided which is home automation. The person can send message or alarm the helper about his needs from the application itself.

IV. SYSTEM ARCHITECTURE

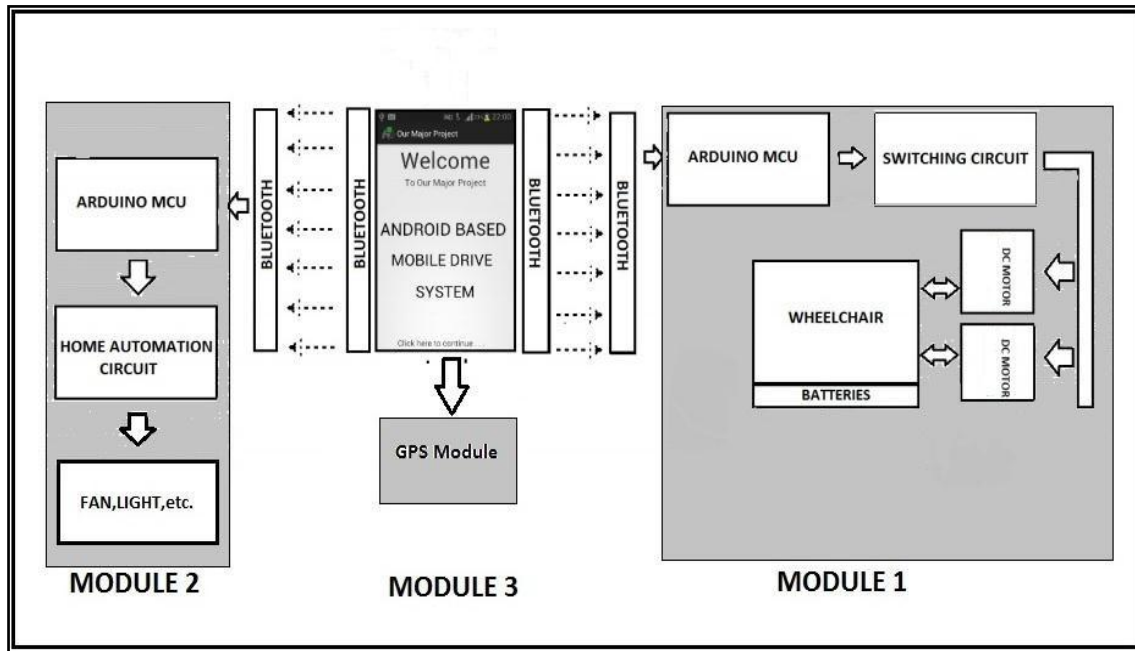


Fig. 2: Block Diagram

In this project, the navigation key of the Smartphone has been used in the wheelchair to decrease the complexity and the price of the system. An application consisting of controlling wheelchair by pressing the key of mobile has been made which sends its data via Bluetooth to the required circuitry to move the wheelchair. Also an option to control the lights, fan and other appliances is available to the helper from the application itself. The project is a result of culmination of various modules and in diagram shows the various modules interfaced using Arduino controller.

- 1) Module 1:
It is an Android application which has Bluetooth linked with controller. This controller controls two external motors of wheelchair using motor drive mechanism. The wheelchair can be controlled by pressing navigation keys
- 2) Module 2:
It is for controlling for home appliances via home automation circuit. It offers a facility to send message for the home automation. It provides

option to switch ON/OFF a particular appliance from list of appliances.

- 3) Module 3:
The wheelchair also has a GPS module to track the current position of Wheelchair. So that wherever the person goes we can keep a track of it always.
– Wheelchair Drive System:
The Wheelchair drives using two DC motors. These two DC motors are controlled by motor drivers. Separate battery is required to drive these motor

V. SYSTEM IMPLEMENTATION

Wheelchair controller is a GUI used to control wheelchair using touchpad of the mobile. Navigation keys are used to control it. The values are acquired from application and then the data is sent to the Arduino controller via Bluetooth module.

Home automation also has GUI used to control home circuitry including fans, lights and TV sets using the

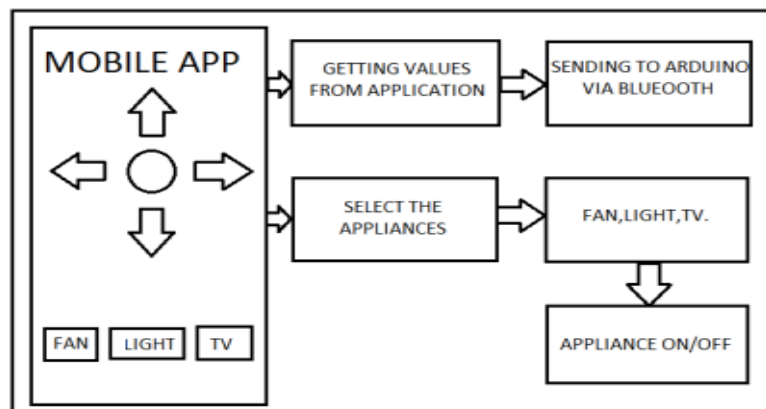


Fig. 3: Flow Diagram

VI. EXPERIMENTAL SET-UP

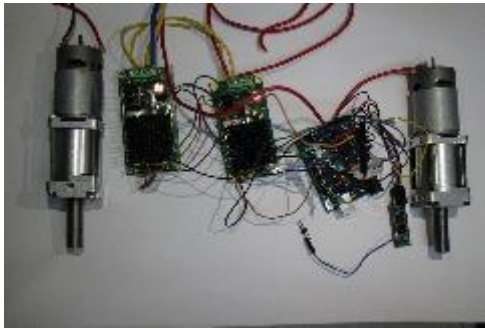


Fig. 4: Experimental setup

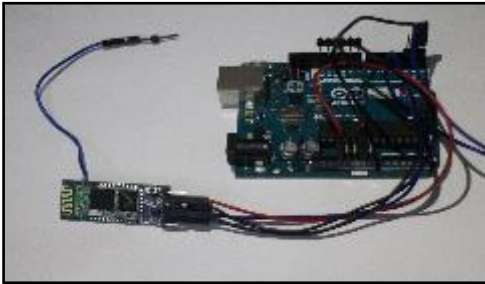


Fig. 5: Bluetooth Interface

The above image shows Arduino Uno along with Bluetooth module interfaced to it. The module has 6 pins out of which 4 pins are of use and connected to the Rxd and Txd of Arduino. Pin state and wakeup are not used. They are connected through one to one connector.

The different modules mentioned above are integrated together to give us the optimum performance and whole drive system. The setup has been then installed on the wheelchair. Finally, the movement of the wheelchair is perfect as per the keys pressed on the application.

In motor testing Hercules motors were connected to drivers. We connected the Hercules motors to the motor drivers and tested the motors by providing it a sufficient voltage and current through a dual power supply. A voltage of 12 V and current of approximately 5 amperes is needed to run the motors. As it is a high torque motor, the current drawn from supply is too high. The drivers provide current amplification so that the small current is amplified to large value so that these motors are driven. The data pins of motor drivers were connected to Arduino Uno from where the data is given to drivers. But for testing purpose the data pins are given VCC and GND signal directly.

In Bluetooth testing the Bluetooth was connected to the Arduino controller and the signal output was observed on CRO. The Txd pin of Bluetooth was connected to the CRO input and data signal was observed. We could observe serial data on CRO.

A. Problem Faced:

Initially the motor driver was not able to provide sufficient current to the motors simultaneously. The current drawn by motors was too small due to which motors were not able to run. The problem was solved later.

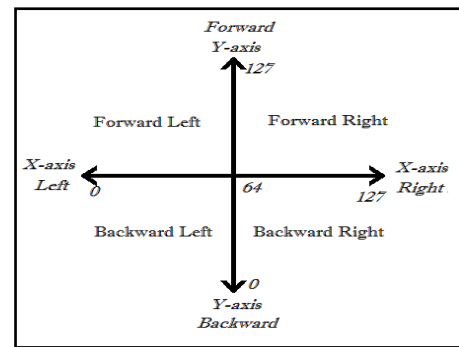


Fig. 6: Graph Showing Relationship between Accelerometer and Wheelchair's Movement

VII. FUTURE SCOPE

Much other advancement are possible in the mobile drive system like using GPS to chalk out the mapping of the area so that the wheelchair can be moved automatically from one point to other. Ultra sonic sensors for obstacle detection can also be used to make the ride smoother.

VIII. RESULTS AND SIMULATION

The Programming is done with the help of ARDUINO software in Embedded C language. Algorithm for the program is like we are sending bits using Bluetooth of phone and receiving the same on the Arduino board using Bluetooth module. We built one ANDROID application having navigation keys for controlling wheelchair and various home appliances like fan, lights etc. Hence with the help of this system we have ease the control of wheelchair using Mobile Phone.

IX. CONCLUSION

Hence with this proposed system we have automated home appliances just on a click and controlled wheel-chair easily.

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